12. Surface Chemistry

- **Emulsion :** Colloidal soln. of two immiscible liquids [O/W emulsion, W/O emulsion]
- **Emulsifier :** Long chain hydrocarbons are added to stabilize emulsion.
- **Lyophilic colloid :** Starchy gum, gelatin have greater affinity for solvent.
- **Lyophobic colloid :** No affinity for solvent, special methods are used to prepare sol.
  [e.g. As_2S_3, $Fe(OH)_3$ sol]
- **Preparation of colloidal solution :**
  i. Disperision methods ii. Condensation method
- **Properties of colloidal solution :**
  i. Tyndal effect ii. Brownian movement
  iii. Coagulation iv. Filtrability

Positively charged colloid	Negatively charged colloid
Hydrated metallic oxide	Metal Cu, Ag, Au, Sol
$Al_2O_3.xH_2O$, $CrO_3.xH_2O$, $Fe_2O_3.xH_2O$	Metallic sulphides As_2S_3, Sb_2S_3, CdS sol
Basic dye stuffs methylene blue sol, Haemoglobin (blood)	Acid dy stuff eosin, congo red
Oxide TiO_2 Sol	Sols of starch, gum gelatin, clay

- **Hardy Schulze Rule**- This rule states that the precipitating effect of an ion on dispersed phase of opposite charge increases with the valency of the ion.

- The higher the valency of the flocculating ion, the greater is its pricipitating power. Thus for the precipitation of As_2S_3sol (–ve) the precipitating power of Al^{3+}, Ba^{2+}, and Na^+ ions is in the order $Al^{3+} > Ba^{2+} > Na^+$.
- Similarly for precipitating $Fe(OH)_3$ sol (positive) the precipitating power of $[Fe(CN)_6]^{-3}$, SO_4^{2-} and Cl^- ions is in the order
  $[Fe(CN)_6]^{3-} > SO_4^{2-} > Cl^-$

- The minimum concentration of an electrolyte in milli moles required to cause precipitation of 1 litre sol in 2 hours is called FLOCCULATION VALUE. The smaller the flocculating value, the higher will be the coagulating power of the ion.

$$\textbf{Flocculation value } \alpha \frac{1}{\textbf{Flocculation power}}$$

➢ Gold Number

- The number of a hydrophilic colloid that will jsut prevent the precipitation of 10 ml of standard gold sol on addition of 1 ml of 10% NaCl solution is known as **Gold number** of that protector (Lyophilic colloid).
- The precipitation of the gold sol is indicated by a colour change from red to blue when the particle size just increases.
- The smaller the gold number of a protective Lyophilic colloid, **greater is its protection** power.
- **Note :** Gelatin and startch have the maximum & minimum protective powers.

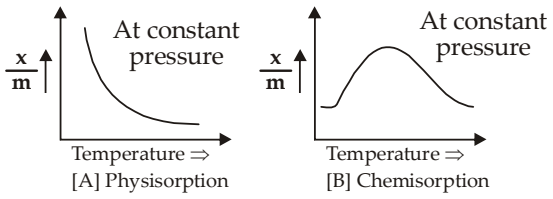
- $\textbf{Protection Capacity } \alpha \frac{1}{\textbf{Gold number}}$

➢ Effect of temperature :

⇒ Extent of Adsorption $\left(\frac{x}{m}\right)$

$x \Rightarrow$ Mass of adsorbate

$m \Rightarrow$ Mass of adsorbent



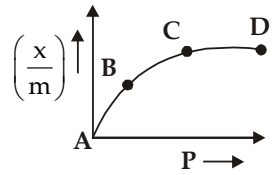
➢ Effect of pressure :

The variation in extent of adsorption with change in pressure at constant temperature can be explained with the help of some graphs called as adsorption isotherms.

i. Freundlish adsorption isotherm :

For physisorption, Freundlish explained the variation in adsorption due to the change in pressure graphically and mathematically as follows :

Here Adsorbate - Gas and Adsorbent - Solid



Case-I At low pressure (A → B)

$$\frac{x}{m} \propto P$$

Case-II At high pressure (C → D)

$$\frac{x}{m} \propto P^0$$

Case - III At intermediate pressure (B → C)

$$\frac{x}{m} \propto P^{1/n} \text{ [Where n = 1 to } \infty]$$

The resultant condition $\frac{x}{m} = KP^{1/n}$

At low pressure n = 1

At high pressure **n = ∞**

At intermediate pressure **1 < n < ∞**

∴ The value of (1/n) ranges from **0** to **1**.

Here,

x ⇒ Mass of adsorbate

m ⇒ Mass of adsorbent

p ⇒ pressure of adsorbate gas

K and **n ⇒** Constants that depends on the nature of adsorbate and adsorbent.